Chapter 7

Poultry Value Chain

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7.1 Introduction

In the livestock sector in India, poultry farming holds a prominent position owing to its impressive growth led by the private sector. Poultry sector has shown rapid growth, with chicken meat growing at an average annual growth rate of 9% and eggs growing at 6% from 2000–01 to 2018–19 (DAHD 2020). The recent steady growth in domestic demand for chicken meat has made it possible to increase production with a ready market putting India among the top poultry producers in the world. India is the third-largest egg producer after China and the USA with a production of 96 billion eggs and fifth-largest chicken meat producer with a production of 3.7 million tonnes in TE 2018–19 (FAOSTAT 2018). This transformation in the poultry sector has been led by the commercial poultry industry, which contributes about 80% of the total poultry production. The other 20% is produced by the traditional backyard poultry. The broiler industry is concentrated in the southern and western states and accounts for a major share of total output. Similarly, the layer industry is dominated by well-developed states like Andhra Pradesh, Tamil Nadu and Maharashtra, accounting for nearly 60% of the production (DAHDF 2017). Commercial poultry farming is yet to make a mark in more populous states like Bihar, Odisha and Uttar Pradesh.

There has been evidently a sharp jump in India's domestic egg and chicken meat production outpacing the two major competitors—beef and veal since 2004–05. Nearly 36% of the production of meat is contributed by poultry followed by buffalo

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(22%), goat (19%), pig (9%) and sheep (8%) (DAHDF 2015). Factors contributing to this growth can be attributed to innovations in technology, institutions and markets. Supply side factors affecting growth arise from rapid technological changes that were absorbed by local producers creating spill-over effects across the industry. The shift from backyard to commercial poultry operations has dramatically increased the number of birds a farmer can manage, resulting in a further replacement of labour with capital and productivity gains (Narrod and Pray 2001). Innovations have played a key role in the recent past. Factors attributed to innovations are initiation of pure-line breeding, domestically, in both private and public sectors. At the same time, development of input sub-sectors like feed mill, hatchery and farm appliances, bio-security and laboratories, and simultaneously aided vertical and horizontal integration in poultry farming were instrumental in the development of the sector.

Poultry farming comes with its own risks, specifically in terms of marketing infrastructure. Lack of adequate cold chain facilities and organized and regulated wet markets results in volatile prices of poultry products. As marketing is controlled by commission agents and private traders, procurement from smallholders in remote and backward areas is hardly prioritized. While it is clear that vertical coordination in agriculture supply chain is instrumental in bringing down costs and risks for smallholders, it has been difficult to prove that it takes place uniformly in the Indian poultry sector. The monopolized concentration of commercial poultry in certain regions has led to a neglect of other rural areas from this revolution. To overcome this, a strong marketing network to strengthen and expand direct farmer-market linkages is needed. Even with a shift towards non-vegetarianism, demand has not been able to keep pace with production, coupled with limited acceptance of processed poultry products in domestic markets, which poses restrictions on the expansion of the sector.

This chapter seeks to capture the dynamics of poultry value chain with respect to four critical aspects-Competitiveness, Inclusiveness, Scalability, and Sustainability, overarched by access to finance that intersect all of these (CISS-F). The study uses a combination of secondary data sources (production, exports and price data from the period 2000–01 to 2015–16) and interactions with different stakeholders during field visits. The study examines the trends and features of the Indian poultry sector, growth of integrators and contract farming models, structural reforms in the livestock sector vis-à-vis poultry and its implication on inclusiveness of small farmers and the financial and environmental sustainability of such growth.

7.2 Overview of the Poultry Sector

7.2.1 Global Overview

The global poultry sector has undergone a series of structural changes during the last two decades making it one of the fastest-growing livestock sectors. The poultry

industry has witnessed modern production technology, genetic improvements, better bio-security measures and improved disease control and prevention. As the world progresses towards increased urbanization and higher incomes, developed as well as developing countries offer opportunities for poultry producers to capitalize on these positive trends.

Developing countries registered an increase in poultry meat consumption of 35 million tonnes between 1990s and 2005, recording almost double of what developed countries experienced (Narrod et al. 2008). Henderson 2015 studied that BRIC countries (Brazil, Russia, India and China), which have a share of 40% in global consumption would play a major role in fueling growth of protein export from countries like the USA. On the contrary, historical trade patterns show that US exporters may struggle to expand their share in these markets, with India, an important case in point. India ranks third in egg production with around 103.3 billion eggs produced in 2018, after China and U.S.A and is the fifth-largest chicken meat producer (FAOSTAT 2018). Poultry meat production in India increased from 69,000 tonnes in 1961 to 4.06 million tonnes in 2018. Figure 7.1 summarizes the top five egg and chicken meat producing countries.

An increase in poultry production means an enhanced demand for maize, which is the largest component of poultry feed. The rise in poultry consumption worldwide has driven global maize production which increased at a compound annual growth rate of 5.5% from 729 MMT in 2004–05 to 1060 MMT in 2015–16 (FAOSTAT 2018). Asia recorded a phenomenal increase in poultry meat production and accounts for about 25% of poultry production.

While global poultry sector has moved towards vertically integrated commercial broiler operation engaging with farmers in a contract mode, the level of integration varies across countries and individual firms. Robust urban demand has fueled the expansion of large integrator models. There is also a preference to set up operations closer to input supplies, as observed in Brazil, for instance. Informal domestic markets in the form of wet markets still dominate in countries like India, Indonesia and

Fig. 7.1 Top Eggs and Chicken Producing Countries (TE 2018). *Source* FAOSTAT (2018)

Vietnam. Brazil and the USA dominate in broiler export market while China is emerging as an active broiler exporter (Narrood et al. 2008).

At present the global poultry market is characterized by a handful of giant poultry companies that control a large fraction of global production, processing and exports, for instance, JBS and BRF in Brazil, Tyson Foods in USA, CP group in Thailand and Wen's Food group in China. It is interesting to note that technology spillovers and competitive production in Asian countries have made some of these companies viable competitors in the global market. Demand side factors are traceable to increase in consumption of poultry meat, which witnessed an unprecedented growth over the years due to its high nutritional value and affordability compared to other meats. Supply side factors involve developing countries as global competitors in the agribusiness sector. Dominated by developed country exporters in the past, the dynamic poultry market of the world is increasingly led by developing countries, which seem to be highly competitive in the coming years.

7.2.2 Domestic Overview

Poultry production in India soared since early 2000s, showing an increase in demand and reduced prices of poultry products in the country. Along with structural changes, there also exists a direct and positive relationship between increase in income and consumption of meat as studied by Mehta et al. (2003). The per capita availability of egg has risen from 5 eggs per annum in 1950–56 to 74 eggs per annum in 2017–18.

Among Indian states, the largest egg producer is Tamil Nadu which produces 19% of the total eggs in the country, followed by Andhra Pradesh (18%) and Telangana (13%). Meat production in general has shot up in the country from 4 million tonnes in 2007–08 to 7.7 million tonnes in 2017–18 with a CAGR of 6.1% in these years. If we look at individual years, the annual growth rate was as high as 13.25% in 2011–12 as supported by the boom of commercial poultry led by large integrators and could also be traced to gains from exports during that period. In TE 2017–18, India produced 3.8 MMT of poultry meat with Maharashtra producing 15% of the total production followed by Tamil Nadu, Haryana and West Bengal (Fig. 7.2).

Although India is a competitive poultry meat producer, due to lack of processing facilities, small farm sizes and no-brand credibility, Indian poultry exports have been abysmally low. India exports smaller quantities of frozen whole chicken and cuts to South Asia, Middle East and more recently, to Japan and South-east Asia (USDA FAS 2016). Poultry products for export traditionally include table eggs and egg powder. The prospects for imports of poultry products in India are limited due to competitive domestic production. Since 2007, import of poultry products has been prohibited from nations exposed to Highly Pathogenic Avian Influenza (HPAI) and Low Pathogenic Avian Influenza (LPAI).

Feed costs in terms of prices of maize and soybean have a serious repercussion on the competitiveness of the poultry sector as input prices related to feed cover (60–70)% of the cost of production. Soybean production declined significantly in

Fig. 7.2 State wise Poultry Meat and Egg Production (TE 2017–18). *Source* Basic Animal Husbandry Statistics (2019)

2015–16 due to drought conditions. Despite recovering from the drought in 2016–17, problems still exist when it comes to availability of soybean and corn, locally. Soybean import is not an option for India due to GM issues. From 2010 to 2015, soya bean and corn prices increased at a compound annual growth rate of 9.8% and 9.1%, respectively, while price of poultry chicken increased by 4.5% only (USDA FAS 2016). Hence, to contain the cost of feed, it will be important to enhance the feed conversion ratio. Singh 2019 reported that feed conversion ratio increased by about 40% owing to productivity gains as well as efficient feeding practices. Estimates suggest that the ratio for broilers increased to 1.65 kg in 2015 from 2.2 kg in the 1990 (Kotaiah 2016).

7.3 Competitiveness

Competitiveness of the poultry value chain has been analyzed at the international and domestic levels. Firstly, we look into India's poultry export basket, trade policies and then analyze whether poultry (chicken and eggs) sector in India is price competitive in terms of Nominal Protection Coefficients (NPCs). Secondly, we discuss a typical value chain of poultry in India and evaluate its domestic competitiveness by computing farmer's share in consumer rupee.

7.3.1 International Competitiveness

India's Poultry Export Basket and Trade Policies

India's participation in world poultry trade was negligible until the 1990s. In 2003, India exported only 0.07% (6.9 thousand tonnes) of 10 million tonnes of poultry meat (Mehta et al. 2008). Currently, India contributes to less than 0.4% of the global poultry and poultry-based trade. India has exported 4.50 lakh tonnes of poultry products worth USD 79 million in 2016–17 (DGCIS 2018).

The Middle East pull effect has resulted in an increase in poultry exports to Gulf countries in recent years. In 2017–18, India's exports to the Middle East were about 3.5 lakh MT (USD 35 million) (APEDA 2018). During the same period, India recorded its highest egg exports to Oman, valued at USD 24 million. Its share in total egg exports from India was recorded at 73%, followed by Maldives (15%; USD 5 Million) and the other Middle East countries such as Kuwait (3.3%) and Qatar (2.3%). Major markets for table eggs are Oman, Kuwait, Saudi Arabia, UAE and Yemen. In 2008, egg powder accounted for 36.1% of India's total egg exports and increased to 56% in FY2014 (Pradhan 2016). However, exports of egg powder declined in recent years and the market for egg powder is limited to Japan and the European Union (EU).

Eggs (hen-in-shell) are the largest component of poultry products exported from India and eggs (dried) are the second largest. A decline in egg exports post 2007–08 can be attributed especially to Japan where the dip was a result of import duties imposed by Japan (8% on egg albumen powder, 21.3% on whole egg powder and 18.8% on egg yolk powder) on Indian egg product exports (Fig. 7.3). This treatment did not help Indian exporters since Mexico under a bilateral agreement with Japan negotiated for zero duty for its export of egg products, making Indian egg powder uncompetitive in the Japanese market (GoI 2017). Exports of poultry meat was 14% of production in TE 2017–18 (Fig. 7.4).

Fig. 7.3 All India egg production and exports. Source DAHDF (2018) of India and APEDA

Fig. 7.4 All India chicken meat production and exports. *Source* DAHDF (2018) of India and APEDA

Potential for Breaking into Global Trade

The growing domestic demand for poultry has not been accompanied by any increase in imports as consumption in India is driven by fresh meat from live markets (90%) and not processed/chilled or frozen meats (around 7–10%). This reflects consumer preferences, inadequate processing, and lack of refrigeration infrastructure. The domestic pull for poultry supply is so strong that it diverts producers away from the export markets as domestic markets fetch a higher price for farmers who do not have the resources or cannot strictly comply with quality standards, to meet international demand. A positive lead has been taken by firms such as Shanthi Poultry Farm (P) Ltd. that freeze and pack chicken meat that comply with stringent international sanitary norms and caters to markets in the Middle East, Europe and America. There appears to be an opportunity where Indian exporters can identify and segregate poultry meat products and find markets for Indian chicken breast meat. Given that the cost of production is competitive with those of high performing countries, a strategy to boost exports would require a focused understanding of international market demands for diversified poultry products (frozen/chilled/chilled cuts) together with a comparative freight advantage as well as a host of other sanitary norms and quality concerns.

Table 7.1 presents a SWOT analysis of the poultry sector that can help strengthen the poultry value chain to cater to both domestic and international markets as well as enable poultry farmers to benefit from the marketing gains.

Table 7.1 SWOT analysis: poultry sector (eggs and meat)

SWOT analysis: poultry sector (eggs and meat)	
<i>Strengths</i>	<i>Weaknesses</i>
<ul style="list-style-type: none"> • CAGR for eggs is 5% and 7% for poultry meat • For last 5 years, CAGR of GVA for egg and poultry is 13% and 15%, respectively (DAHDF 2017) • Backyard poultry contributes nearly half of household income in terms of livestock rearing for rural households • Coping with production of maize and soya bean • Integrators in the value chain of commercial poultry, proving contract farming has worked in this sector historically 	<ul style="list-style-type: none"> • Lack of infrastructure; Processing, cold storage, refrigerated vehicles • Sanitary conditions in handling of meat • No division between White & dark meat in the consumer market (hence no premium chargeable by producers)
<i>Opportunities</i>	<i>Threats</i>
<ul style="list-style-type: none"> • 90–95%—Wet markets, still scope to transform, markets for chilled chicken are increasing as opposed to frozen chicken • Initiatives to develop LIT (Low Input Technology) birds by CPDOs for backyard poultry • Untapped potential for exports of diversified value-added products • More state-of-the-art technology in the egg processing sector (low cholesterol & omega-3 rich designer eggs) • Brand development for indigenous breeds like Kadaknath and Aseel • Formulating Good Practices (SAPPLPP) & Industry–R&D partnerships 	<ul style="list-style-type: none"> • Avian influenza • Mono-breed-Venky's Vencobb captures 70% of market share • Rise in domestic maize prices due to MSP

Source Authors' adaptation from GoI No Date

Nominal Protection Coefficient (NPC)

For the purpose of calculating NPC for eggs and chicken meat, weighted average wholesale price of eggs and chicken meat are taken from the Directorate of Economics and Statistics (several issues of Agricultural Prices in India) for Andhra Pradesh and Tamil Nadu (which constitute more than 50% of production). The FOB price has been adjusted with respect to port handling charges, transportation and freight (margins obtained from industry sources). India has been traditionally competitive in egg production and has exported large volumes of egg products to the markets in Japan and the Gulf. NPC of eggs-in-shell has been less than 1 for most of the study period (2003–04 to 2016–17). However, with the onset of Avian Flu outbreaks and certain tariff on Indian egg exports by Japan, the competitiveness has gone down post-2010. Egg exports have dominated poultry exports as a whole and have remained competitive from the start except for certain years due to volatility.

As far as chicken meat is concerned, 2005–06, 2006–07 and 2007–08 were years, when production of chicken meat in India was badly struck due to Avian Flu and adversely impacted the reputation of Indian broiler meat (Fig. 7.5). The entire industry suffered as a result of which even though India was a competitive producer, export of broiler meat was dismally low. Post containment of Avian Flu and after revival of the poultry sector, exports have risen but not as expected, compared to exporting giants like Brazil, Thailand and USA. For instance, according to a Kuwait based Broiler Company, the demand in Gulf for frozen chicken is 60,000 tonnes per month. The Indian broiler company only sells 1000 tonnes per month to Kuwait. Although there is a large demand for exports, Andhra Pradesh exporters face quality issues. Due to fragmented and small-sized poultry farms with poor or no processing, refrigeration and cold-chain infrastructure facilities, the quantity for actual exports after quality checks is very low. Poultry meat was competitive since 2003–04 but has been able to find a minute place in the global market (Fig. 7.6). As mentioned earlier, India has the potential to breakthrough in price competitiveness while competing with traditional exporting giants like USA and Brazil.

Fig. 7.5 Egg exports and nominal protection coefficients. *Source* APEDA and Authors' calculation

Fig. 7.6 Chicken meat exports and nominal protection coefficients. *Source* APEDA and Authors' calculation

7.3.2 Domestic Price Formation

Vertical Integration of Technology and Markets

Traditional poultry production is an imperative part of rural farm household activities, while commercial poultry is a flourishing agri-business sector. However, Department of Animal Husbandry, Dairying & Fisheries (DAHD&F), Central Poultry Development Organizations (CPDO) and Indian Council for Agricultural Research (ICAR) prioritize backyard sector and started promoting small-scale, semi-intensive commercial poultry models using local or crossbreeds. The major share of egg and meat production (80%) comes from the commercial sector which can be further categorized into contract and non-contract farms. The success of this widespread integration model in the west and south comes from the set-up of the model itself.

A contract farming agreement in the case of broiler farming is referred to as a chick growing agreement, wherein an integrator supplies inputs and procures the output, thus establishing key control and ownership of major components of the value chain. The integrator provides day-old-chicks (DOCs), feed, veterinary services, and vaccines to the contract farmer and the contractor also takes charge of the final marketing of the output either in wet markets or for further processing and distribution. The contract farmer provides his land, housing, equipment (litter shed), labour (family or hired) and takes care of day-to-day farm management. The contract is based on the assumption that both parties will honour their role and attain maximum performance from the flock. There are certain incentives given along with growing charges, if the farmers perform better than the fixed standards/specifications. For instance, contract farmers are given an incentive bonus if the Feed Conversion Ratio

(FCR) and/or mortality rate is lower than those agreed upon in the contract. Thus, poultry growers benefit from considerable price assurance and risk mitigation. Integrators, typically, pay contract growers pre-decided prices for about 42 days old broiler birds (Narrod et al. 2008).

Feed, comprising of maize and soymeal is the largest component of production costs for both broiler and layer production, accounting for (65–70)% and (75–80)% of total production costs, respectively. Poultry integrators have followed a trend of expansion in Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra. Around Pune, Venkateshwara Hatcheries and Godrej Agrovet Group together have about 6000 contract farmers. Suguna has a major hold in the south and account for 60% of production, unlike northern regions where integration has moved rather slowly. Contract farming has considerable potential and advantages for small and marginal farmers who cannot be competitive on their own due to lack of literacy, resources and access to markets. Since small and marginal farmers dominate the Indian agricultural landscape and livestock in particular, contract farming fills the gaps by providing technical guidance, input sourcing, management skills and technical knowledge. This allows fulfilling the twin objectives of skill-building and income generation. Assured input and buyback are the real game changers. Table 7.2 illustrates the cost and benefit accruing to the farmer in contract and non-contract poultry farmers.

The farmer under the contract farming model gets 4.7% of the consumer rupee. However, this share is much lower compared to other value chains because the major cost of production and input provisions are taken care of by the integrator, and not the farmer (Fig. 7.7). This puts the risk burden on the integrator who makes 60% of the consumer rupee.

The wholesaler connects the producer and the retailer and operates on a smaller margin which comes to 7.8% of the consumer rupee (Fig. 7.8). However, the retailer has a critical role to play in converting the live chicken into raw meat, apart from his other operating costs.

Table 7.2 Risk mitigation and assured return in the broiler integration model

Cost/benefit to farmer	Non-contract farmer	Contract farmer
Day-old chick cost	Yes	No
Feed cost	Yes	No
Labour and land cost	Yes	Yes
Medicine/veterinary services	Yes	No
Initial investment barrier	Yes	No
Insulation from market price fluctuations	No	Yes
Finance available	12.5% p.a. (repayment time is 6–8 years)	

Source Field study

Fig. 7.7 Input cost (INR/kg). *Source* Field interactions

Fig. 7.8 Markups for poultry meat (Andhra Pradesh and Tamil Nadu). *Source* Authors' calculation.
Note The calculations are based on the assumption that 1 kg live bird is equivalent to 750 g of meat

7.4 Inclusiveness

The Indian poultry sector is by far one of the few sectors that have proven to be inclusive as far as production activities are concerned. Although there are variations in benefits accruing to different stakeholders, poultry has attracted large and small farmers, alike. Geographic and cluster production has been the trend in India. More than 60% of eggs are produced in Andhra Pradesh, Maharashtra, Punjab, Haryana, Tamil Nadu and around 60% poultry meat is produced in Andhra Pradesh, Maharashtra, Punjab, Karnataka and West Bengal. Such variations put certain states at a disadvantage as the benefits of economies of scale are not spread out evenly. The

polarization of regions where maximum backyard poultry is practiced leads to inefficiencies along the value chain—technology barriers, high production costs, no market incentives and lower returns.

As commercial poultry is a sustainable option for income generation for a large number of smallholders in rural areas, it is essential to provide an enabling policy environment which encourages the collectivization of smallholders. This calls for innovations in policy and institutional frameworks. The 2017 scheme of Innovative Poultry Production Project (IPPP) under the National Livestock Mission (NLM), aimed to enhance egg production towards scaling-up of small low-input producers to make their ventures profitable. Under IPPP, the number of birds provided to broiler and layer farmers have substantially increased, compared to the Rural Backyard Poultry Development Program (RBPDP), thus benefiting backyard farmers and rural communities. Another positive impact of promoting backyard farming is its potential to promote greater genetic diversity amongst the birds while giving them a less crowded and less stressful environment. They rely on feed which is naturally procured and is free from antibiotic use, therefore minimizing the risk of emergence of new disease strains.

Narrod et al. (2008) identified five essential elements in ensuring smallholders have fair access to agricultural markets. These include extension service and assistance for high-value quality produce; modern infrastructure that helps reduce costs of marketing; access to reliable market intelligence; bandwidth to farm certifiable quality produce; and prompt farm to market linkages, to leverage existing demand. Poultry farming model similar to Amul milk collection and marketing model could help small farmers to collectively market their produce across India. Along with marketing channels, extension and veterinary services should acquire a pivotal role, if inclusiveness is to be addressed. There is enough evidence to support the fact that the growth of the sector has taken place largely with help of private capital. Given strong market opportunities, strong backward linkages with small poultry farmers have the potential to create win-win situation for all actors in the value chain.

As far as institutional support is concerned, there are subsidies that exist but are targeted at commercial poultry or exports, which is imperative as well, but social safety nets (subsidies or insurance) for smallholders is still missing from the framework. The lack of insurance schemes that are tailored to the needs of vulnerable poultry farmers is a major setback for their expansion. Smallholders can compete with modern commercial poultry because of acquired productivity advantages. However, it should be emphasized that there is a need to substantially increase public investment, particularly for institutional development to help smallholders overcome high transaction costs while accessing quality inputs and markets.

7.5 Sustainability

The Indian poultry industry is at a turning point with ever-growing implications for sustainability of the sector as a whole and welfare of smallholders, in particular.

At this point, it becomes essential to analyze the viability of the sector, so far and what the future looks like, given the growing demand for poultry products driven by consumer behaviour, technological breakthrough and adoption of the integrator model. The question of sustainability thus rests on two pillars—environmental and financial. With strides in development, there are environmental costs that need to be abated because of rising pressure on resources, recognition of safety standards and animal welfare conditions.

The vision of aligning Indian poultry with world standards and standing up to stiff competition would mean taking into consideration certain laws that demand quality assurance. Thus, there is a shift to more evidence-based decision-making systems and the need to establish traceability of poultry products. These factors affect the entire value chain starting from hatcheries to feed mixing units and the final sale of finished meat products.

7.5.1 Financial Sustainability

Feed Market Implications—Variation between Feed Price and Poultry Production

If production has to remain competitive, the sustained availability of high quality and affordable feed is crucial. Poultry feed accounts for 47% of total maize consumption (FICCI 2018). Maize largely remains the preferred energy source for the sector and is expected to grow from 26 MMT in 2016–17 to 45 MMT by 2022 (India's Maize Vision 2022). India's maize yield of 2.5 MT/hectare is lower than the global average of 5.5 MT/hectare (FICCI 2018), though there is evidence of much higher yields being obtained in various parts of India. One of the reasons explaining this could be the fact that only about 30% of the area is under SCH (Single Cross Hybrid). Adoption of SCH technology was the driving force behind increasing productivity of maize in countries like USA and China; replication of same in India calls for a change in policy perspective. Poultry sector in India can benefit from increased R&D in developing maize hybrids and their rapid adoption and the private sector can play a larger role in strengthening the maize value chain.

Catering to Markets and a Vision for the Future

In India, there exists a dominant wet market for poultry meat, and rural and urban consumers, alike, prefer live meat markets. This limits the processed chicken meat sector to only (7–10)%. However, as firms start diversifying and expanding operations, they come up with innovative marketing strategies. For example, Suguna's layer variety, Lohmann LSL-Lite is capable of producing over 325 eggs in 72 weeks saving production cost of over 3% per egg. In terms of branding strategy, Suguna's eggs were priced more than the unbranded local eggs in the market and to justify the premium, Suguna employed product differentiation; their eggs were clean, shiny and uniform in size and shape and packed attractively. Additionally, to cater to the needs of high cholesterol patients, Suguna has a range of eggs under the variant Suguna-Heart which are rich in Omega-3 fatty acid and contain less cholesterol.

The firm's product differentiation strategy is not only a domestic market-led initiative, it also places the firm at the centre of modern technology, which is recognized globally. The export impetus that India needs has come institutionally more from the private sector as far as breeding and export readiness are concerned. Suguna has a turnover of INR 7870 crores (in FY2019–20) and a state-of-the-art processing plant in Tamil Nadu with an operational capacity of 3600 birds (1500 MT) per month. Suguna's processing plant is closely monitored by Export Inspection Agency (EIA) and Meat Food Products Order (MFPO) of the Ministry of Food Processing Industries (MoFPI) as it is approved by the government for exports. Suguna was the pioneer in poultry integration when it started a contract farming system with 200-layer birds in Udumalpet, Tamil Nadu in 1986. Now it boasts of a farmer network of 30,000 in 18 states across the country.

The Integrator System and Sustainability

The integrator model has been successful in making poultry farming profitable for small farmers by undertaking the costs and risk of poultry farming. This together with the ability of the integrators to cater to a large market for poultry products and investing in the supply chains have positive implications for its financial sustainability. By streamlining the value chain, integrators are able to cater to rising demand at affordable prices and deliver higher gains to the farmers. At first glance, it would seem that integrators assume a significant risk to protect farmers, but the returns received cover their costs and risks, thus making them operate on a good profit margin. Suguna's average operating profit margin over five years is about (7–8)% and net profit margin is around 4%. For Venky's, net profit for the first quarter of 2018, stood at INR 69.42 crores, up by 66.4% from last quarter of 2017.

In addition to integrator model, poultry value chains driven by co-operatives and producer companies have been successful in strengthening inclusive growth. Structured on the lines of integrator model providing inputs, day-old chicks, advisory and extension services as well as market linkages, such models have the potential to positively impact large number of vulnerable people who struggle to participate in these mainstream livelihood options owing to lack of financial resources and absence of market linkages. One such example being that of Madhya Pradesh Women Poultry Producers Company Private Limited that has its genesis in PRADAN led poultry producer collectives comprising of Gond tribal women in the Kesla block in Madhya Pradesh in 1994. This market-led model was first of its kind in integrating women poultry producers living below poverty line to competitive poultry markets and delivering income security to the women. The first co-operative was registered in 2001 as *Kesla Poultry Sahkari Society Maryadit*. As on 2018–19, there were 14 co-operatives and Poultry Producer Companies under the Madhya Pradesh Women Poultry Producers Company Private Limited, which is an apex federation. The membership stands at 8121 all women members with a sales turnover of INR 297.7 crores and member profits of INR 24.9 crore, about 8.4% of the turnover. Under a smallholder broiler model, each woman producer has 500–1000 birds and rears five to six batches annually. This fetches an income of INR (40,000–80,000) per year for 200 days of work at the rate of 3–4 h a day. For layer farm of 400–500

bird size and yield of 320–340 eggs in 52–60 weeks, each woman producer makes about INR (55,000–60,000) per year.¹

Harshvardhan (2010) reports that KPS has been paying higher rearing charges to its poultry growers compared to the integrators in different parts of India. While KPS has been successful in delivering higher incomes to individual growers, the larger impact will be seen when small growers do not face any hurdles in joining such collectives. Models such as KPS that have come at par with integrators in terms of scale of operations are enabling penetration of organized poultry farming beyond southern and western states. Also, the decentralized model of poultry farming will be effective in strengthening the inclusiveness of poultry value chains.

7.5.2 Environmental and Epidemiological Implications

Efficient poultry farm management in terms of safe handling of dead birds and farm waste are necessary to prevent environmental hazards including water contamination, among others. During disease outbreaks, it becomes critical to ensure safe disposal of dead and infected birds without which the environment can be adversely affected. The environmental impact of poultry production depends on farm size, production systems, diet composition of birds, type of infrastructure and bio-security levels. There have been rising sustainability concerns which in turn have led to recommending the use of poultry manure and litter as a soil fertilizer for crop production. Organic production of poultry has emerged as an alternative production system. Litter from birds contain significant amount of nutrients essential for plant growth and in some states under certain smallholder programs, poultry litter is converted to bio-gas, but a large-scale intervention is needed at the national level. Van der Sluis (2007) reported that poultry meat and egg production were environmentally less burdening than beef, sheep and pork production. For instance, global warming potential (CO₂ equivalent) was 3.6 in poultry meat production compared to 15 in beef; and 17 in sheep meat. Gerber et al. (2013) studied that while beef production accounted for 41% of the GHG emissions, poultry meat and egg production contributed to 9% and 8%, respectively.

Avian Influenza and the Degree of Economic Losses to Producers

The single most devastating threat to the poultry sector are diseases like Avian Flu (highly pathogenic avian influenza (HPAI), A (H5N1) and H7N9), which can completely wreck the profitability and productivity of poultry, for big and small players, alike. The severity of these disease outbreaks disrupt both production and consumption patterns, as observed in India and other countries. World Organization for Animal Health (WOAH) and FAO play a critical role in issuing guidelines and charting out clear actions with respect to monitoring and containing the outbreaks at a global level. India has benefitted from the Prevention and Control of Infectious

¹<https://mpwpcl.org/>.

and Contagious Disease in Animals Act, 2009, which regulates the outbreak across states as well as provides quarantine guidelines. The relevant and applicable framework makes sure the spread of any infectious disease is contained in the particular state/region and urgent steps are taken to reduce the far-reaching negative impacts of the outbreak. However, disease surveillance remains an area of concern in the livestock sector.

HPAI has strong micro-impacts in the regions affected and a macro impact as a result of an interconnected global trade route. With the onset of an epidemic, small growers face significant costs related to culling of birds and restocking (Verbiest and Castillo 2004). Also, as measures to control the epidemic are rolled out, cost of production increases, which again poses a financial burden on the small poultry growers. The study by Kumer et al. (2008) in Manipur, post the outbreak of HPAI in July 2007, shows that about 3.39 lakh birds were culled post the notification issued by Government of India. With nearly (43–79)% of the household income in Manipur coming from the poultry sector, the outbreak had severe economic consequences for the layer and broiler producers. The study estimated that while the producers suffered a loss of INR 31.6 million, the government compensation was only INR 9.9 million, which was grossly inadequate. While the farm gate price of broiler was INR 56/Kg, the compensation was INR 30/Kg and there was no mechanism to account for the economic losses suffered from damage of eggs. In addition to the income and livelihood loss, such outbreak poses immense challenges related to compliance in bird culling and operations in containing the outbreak. Given that the poultry sector is threatened by such disease outbreaks, sustainability of livelihoods of small growers emerges as a major concern.

7.6 Scalability

India's poultry sector is characterized by the co-existence of a high capital and technology intensive sector (which is controlled by integrators and has major potential to propel India into global poultry trade), and backyard poultry sector (which has strong implications on poverty reduction and nutritional improvement in rural areas).

7.6.1 *Vertically Integrated Production Systems and Inflow of Technology*

The structural changes experienced by the poultry industry cannot be ignored as the accelerated growth has benefitted small and marginal farmers by establishing a contract farming system with its own risk-assurance and extension services within the model (Fig. 7.9). The increase in consumer demand for poultry led to movement towards mass production in 1980s in a unique manner which was not seen in any other industry in the country during that period. Figure 7.10 provides a snapshot of

Fig. 7.9 The various stages of poultry revolution in India. *Source* Authors' calculation

Fig. 7.10 Key pillars of innovation for poultry sector. *Source* Authors' own illustration

the key pillars of innovation that aided this transformation. Integrators came into the market and brought new technology and production systems that transformed the sector. This was accompanied by a shift from indigenous bird varieties to hybrid birds with special characteristics like increased hatchability, faster growth of chicks and more eggs/meat per bird. Emphasis on innovative research resulted in giant leaps in the productivity levels of eggs and broilers in the 1970s.

Figure 7.11 depicts that the future gains in the poultry sector will be driven by the integrator/organized model. The organized sector provides greater scope for processing and retailing, which will be important for scaling up the poultry value chain.

Fig. 7.11 A typical integrator model of poultry. *Source* Authors' own illustration

The contract farming system has a mutually binding contract that is followed by the integrators and the contract farmers and there is very little room for error or non-compliance. The design of the contract helps balance out the inefficiencies and absorb risks by the integrator in return for the specified output demanded. The contract specifies the mortality rates (set around 5%), Feed Conversion Ratio and weight of birds (between 1.8 and 2.2 kg). India started off with a low feed conversion ratio (FCR) of 2.2 in the 1990s and now it has an internationally competitive FCR of 1.65, which has been possible through the advancements made in genetics, veterinary health and poultry feed improvement—all of which were pioneered by integrators. According to industry sources, Vencobb is the preferred broiler breed which was derived from the Cobb variety and further enhanced and brought into the Indian market by Venkateshwara Hatcheries. Vencobb has the ability to withstand extreme temperatures and has competitive feed efficiency. Ross, Marshall, Hubbard, Hybro-Avian and Anak are some of the other popular breeds (USDA FAS 2016).

7.6.2 Availability of Low-Priced and High-Quality Animal Feed in Southern and Western India

It is imperative to consider why most integration operations are concentrated in a few states resulting in increase in production of poultry meat (Fig. 7.12). Although the industry as a whole has benefited from scientific leaps in poultry breeding and disease control, the availability of low cost and high-quality feed has further fueled this growth (Ravindran 2013). Until the 1980s, 70% maize was primarily consumed as direct food and the rest was used as inputs for feed and industrial use in equal proportions (Singh and Pal 1992). However, in the last three decades, the proportion of maize used in the poultry feed industry has risen rapidly and accounts for 47% of India's maize production (FICCI 2018). Presence of vertical integration in southern region has helped ensuring feed is available easily and at affordable rates, thereby lowering the cost of production compared to other regions (Narrod et al. 2008).

Increase in production levels in recent years has been largely due to an increase in the size of poultry farms given a host of other inter-related factors (NCAER 2015).

Fig. 7.12 Top poultry meat-producing states over recent years. *Source* Basic Animal Husbandry Statistics

Unlike earlier, when broiler farms produced on average 200–500 chicks per cycle, at present units with 5000–50,000 birds per week cycle are quite common. These entities are increasingly engaging in the integrator/contract farming system. High cost of feed, veterinary services including vaccines, transportation costs and lack of adequate finance are rendering smaller units economically unviable.

7.7 Access to Finance

Credit facilities for the poultry sector are available from commercial, co-operative and regional rural banks (RRBs). NABARD provides refinance facilities for poultry production and marketing. The accessibility and ease of procedural norms are still to be evaluated carefully. Besides providing financial resources, NABARD has also guided preparation, appraisal and monitoring of various schemes. Table 7.3 provides the financing requirements of poultry broiler farmers with respect to the farm size in different states that were studied.

In the case of a farmer interviewed in Hisar, Haryana, no loan was taken from the bank. The farmer used his own agricultural land and made his own investment. In Andhra Pradesh, farmers under the Suguna contract took loans from state banks at an interest rate of 12.5% per annum. Also, 8 out of 14 farmers studied relied on formal source of credit subject to their farm size. However, the loan system is still biased towards asset-owning farmers.

Table 7.3 Financing requirements of poultry broiler farmers

Farm size	Approximate cost (capital cost only)	States reviewed
500 birds	INR 1.61 lacs	Andhra Pradesh
1000 birds	INR 3.22 lacs	Andhra Pradesh
4000 birds	INR 9.5 lacs	Telangana
8000 birds	INR 19 lacs	Telangana
10,000 birds	INR 20 lacs	Andhra Pradesh, Telangana
30,000 birds	INR 60 lacs (automated)	Hisar

Source Field study

NABARD and Ministry of Micro, Small & Medium Enterprises (M/oMSME) promotes the Poultry Venture Capital Fund (PVCF) scheme for strengthening the poultry industry by generating employment or entrepreneurship opportunities in backward areas. Integrators like Venky's have better access to finance in the value chain, passing on the benefits indirectly to farmers and securing risks. For instance, Venky's finances most of their operations via reserves and surpluses, term borrowings from banks and a small percentage through share capital. The cost break-up of a contract broiler production value chain (item-wise) is summarized in Table 7.4.

Table 7.4 Costs, margins and sources of finance for poultry farmers

Cost/details	Integrator 1 Tamil Nadu	Integrator 2 Andhra Pradesh
<i>Cost</i>		
Rearing charges	INR 4.15/kg (INR 3.5/kg-minimum)	INR 7/kg (INR 4/kg-minimum)
Cost of production to the integrator (fixed by the company)	INR 60/kg	INR 72/kg
Cost of day-old chick	INR 20/chick	INR 22/chick
Mortality	5%	3–4%
FCR	1.7	1.7
Average no. of days to reach max weight	35–38 days	38–39 days
Average body weight	2 kg	1.8–2.1 kg (winter/summer difference 500 g)
Batches	5–6 batches per year	5–6 batches per year

(continued)

Table 7.4 (continued)

Cost/details	Integrator 1 Tamil Nadu	Integrator 2 Andhra Pradesh
<i>Margin</i>		
Wholesaler	INR 4–5 per kg (mark-up = INR 10 per: INR 5/kg for expenses like lifting, transportation, etc. + INR 4–5 for margin)	INR 2–3/kg
Trader/dealer		INR 2–3/kg
Retailer	INR 20/kg (margin)	INR 10/kg or INR 20 per bird (2 kg bird will give 1.6 kg meat with this particular integrator's birds, otherwise a 2 kg bird fetches 1.3 kg meat)
Finance		70% of poultry farmers finance from their own pocket 30% farmers take bank loans (Indian Bank and Axis bank are largely active in this area) Only a few farmers get loans sanctioned depending on security provided Rate of interest 1–1.5% per month
<i>Average farmer's return in Southern India</i>		
Farmer gets	INR 6/kg (cost + incentive); bird weight 2–2.5 kg	
Farmer's cost	INR 2.5/kg	
Net return	INR 3.5/kg	
Cost of setting up a farm	500 birds—1.61 lacs 1000 birds—3.33 lacs 4000 birds—12 lacs	4000 birds—9.5 lacs (Telangana Animal Husbandry Dept.) 8000 birds—19 lacs 30,000 birds—66 lacs

Source: Authors' estimates based on field study

As per a survey in 2001, commercial loans to the poultry farmers were available at around 15% per annum which was lower than that available from the informal sources (Ramaswami, et. al 2005). In northern India, integrators regarded enlistment, organization, or management of contract farmers as significant issues. The southern states have been able to handle the financing problems relatively better, which was evident during the field interactions with contract broiler farmers of Suguna. A summary of the detailed interaction with industry sources and farmers gives an abstract picture of farmers accessing institutional finance or whether they rely on self-finance which is either through savings or borrowing from informal sources (Table 7.5).

Table 7.5 Share of formal finance by poultry farmers

Region	Average farm size	Per cent of self/formal finance
Ludhiana (Punjab)	7000–8000 up to 25,000 birds	50% each
Madanapalle (Karnataka)	5000 birds	8/14 farmers use formal lending
Bangalore (Karnataka)	5000 birds	–
Odisha	3000 birds	80% self-financed

Source Field interactions

7.8 Conclusion and Policy Recommendations

The Indian poultry industry is export competitive in egg-hen, eggs-in shell, eggs dried and eggs-liquid. Although export competitive, chicken meat exports have been dismal due to rising production costs doubled with the onslaught of Avian Influenza (AI) and lack of infrastructure pertaining to storage, cold chains and export willingness. The domestic industry is price competitive in production of meat in southern and western India. The cluster-export approach production model may work and can be replicated. Given the importance of feed in the poultry value chain, maize and soya bean price movements are fundamental determinants of the competitiveness and sustainability of the sector. Inclusiveness is limited in the commercial model but more dispersed models like the Kesla Poultry Model have delivered higher economic gains to the marginal and disadvantaged population, including women. Retail prices and producer-retail margins are generally higher in the northern region, where poultry integrators are least active. There is very limited scope for producers from low-cost regions to market their product in high-cost regions. Issues related to disease outbreak and unregulated use of antibiotics fuel certain perceptions that affect demand for poultry products and hence marketability. These perceptions need to be corrected and we should move to a more responsible system with awareness and surveillance campaigns. Based on the findings of the study, we recommend the following policy measures to ensure a more competitive, inclusive, sustainable and scalable poultry value chain with enhanced financing mechanisms.

- Expanding the scope of mid-day meal scheme for school going children to include at least two eggs per week along with milk is an effective way of expanding markets that will help provide remunerative prices to local producers. The suggestion is rooted in the idea of a decentralized market mechanism where local, small and marginal poultry farmers get a ready market and scale-up their production to cater to this new semi-urban and rural mid-day meal market. This will subsequently increase the overall demand at the national level. If 50% of 9.5 crore children i.e., 4.75 crore children who are served mid-day meals consume 2 eggs per week, then total demand for eggs will be approximately 5 billion eggs, annually.

- Foreign direct investment (FDI) in the poultry value chain to upgrade infrastructure, boost uptake of technology, improve farm management practices, can add a further boost to the sector for which the incentives and creation of an enabling environment will be critical.
- Poultry export market can be expanded, provided there is freight advantage and India is able to compete with Brazil and USA.
- Growth in the poultry sector is confined to zones and clusters in the west and south—thus increasing the regional foot print in states with a higher potential (catering to domestic markets). This needs to be panned out across the country to help potential poultry farmers benefit from commercialization and greater integration of poultry farming.
- Maize prices have a direct bearing on the cost of production and any policy affecting prices would have a direct and critical impact on poultry producers' profitability. Hence policy measures to increase productivity of maize and making quality feed available at affordable prices should be a priority.
- Strengthening access to veterinary and extension services for non-contract farmers, adequate provision must be made for the establishment of veterinary ITIs (as has been done in Andhra Pradesh), which would result in more number of veterinary technicians at the grass-root level.
- Supporting collectivization of smallholders to achieve economies of scale (for example, co-operatives, producer companies) would ensure the supply of inputs (day-old-chicks, veterinary services including vaccination, feed, production supervision and monitoring,); facilitate and enable market linkages; and mitigate price risks.
- Addressing food safety issues along with effective surveillance (early detection) and containment mechanism for diseases, especially, Avian Flu would significantly reduce the negative impact on domestic as well as export demand.
- Other important issues such as animal ethics and welfare will have to be considered to strengthen the value chain. Technologies like artificial intelligence, robotics, etc. in the livestock sector will play an effective role in overcoming the challenges.

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